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MINUTES OF THE MEETING OF THE NORTH CENTRAL CORN BREEDING RESEARCH COMMITTEE

1960

Reported by
G. F. Sprague, Secretary

Crops Research Division
Plant Industry Station
Beltsville, Md.
CR-23-60 April 1960

TABLE OF CONTENTS

	Page
Morning Session, March 2	
Report of the Sub-committee on the Preservation of Germ Plasm---	2
" " " " Grouping of Lines for Breeding Purposes. ----------	3
" " " " Cytoplasmic Male Sterility and Restorers. ----------	5
" " " " Meeting Place. ----------	5
" " " " Cooperative Winter Nurseries.	6
" " " " Maturity Studies. ----------	9
Afternoon Session, March 2	
Interrelationships of Plant Populations, Shading and Nitrate Metabolism. ----------	12
A New Bacterial Disease of Corn Occurring Under Irrigation in Wisconsin. ----------	14
Interactions Involving Cytoplasmic Male Sterility, Fertility Restoring Genes and Environmental Factors. ----------	15
Stalk Rots - Our Current Knowledge of Stalk Rots of Corn. ------	16
Stalk Rots - Proposed Studies. ----------	18
Morning Session, March 3	
Committee Reports on:	
The Uniform Tests in the 900 Maturity Series. ----------	21
" " " " 700 and 800 Maturity Series. --------	32
" " " " 400, 500 and 600 Maturity Series.----	44
" " " " 100, 200 and 300 " " ----	50
Resistance to Leaf Feeding by the European Corn Borer. ----------	52
Committees for 1960-61. ----------	54
Roster of Attendance. ----------	55

NORTH CENTRAL CORN BREEDING RESEARCH COMMITTEE

Minutes of the meeting held in the Illini Room of the LaSalle Hotel, Chicago, Illinois, March 2 and 3, 1960.

MORNING SESSION, MARCH 2

The meeting was called to order by Chairman Arne J. Ullstrup at 9:00 a. m. Following introductions, the Chairman called for reports from the various sub-committees.

REPORT OF THE SUB-COMMITTEE ON PRESERVATION OF GERM PLASM

As far as is known, none of the North Central States initiated any new germ plasm preservation work during the past year. The committee did make a couple of suggestions which might be worthy of consideration by the group. One is the possibility of making available a report of results obtained when breeders use germ plasm collections so that others might become aware of any special attributes contained in various stocks. This of course would have to be on a voluntary basis. This could conceivably be a great help to others in certain instances. Secondly, it has been some years since we have had an up-to-date listing of the material which is being preserved by the various stations. It might be desirable to bring this up-to-date.

The National Research Council Committee on maize preservation has in galley proof "Races of Maize in Bolivia" #747. Other publications planned and in preparation are for Peru, West Indies, Chile, Venezuela and Ecuador. Seed of the races which have been described in publications have been, or are being grown in Latin American countries for storage at the National Seed Storage Laboratory at Fort Collins, Colorado.

J. H. Lonnquist
E. J. Dollinger
D. B. Shank, Chairman

It was MOVED by M. S. Zuber that the report be accepted.

Seconded and passed.

REPORT OF THE SUB-COMMITTEE ON GROUPING OF LINES FOR BREEDING PURPOSES

The group A and B assignments were reviewed and some of the older lines dropped and newly released lines added. A current list is presented below.

GROUP A

A90	C103	K150	ND230	R53	WH
A158		K201	ND255	R59	WJ
A165		K201G		R61	W64A
A188	CI.2		Oh04	R71	W75
A218	CI.7	Ky.21	Oh4C	R74	W79A
A223	CI.31	Ky.27	Oh5	R75	W153R
A254	CI.38B	Ky.49	Oh13	R76	W117
A264	CI.187-2	Ky.122	Oh40B	R84	
A265	CI.317B		Oh41	R103	
A277		L97	Oh43	R105	
A293		L503	Oh45	R109B	
A295	H14		Oh45A	R151	
A334	H22	Mo1W	Oh45B	R153	
A344	H30	Mo2RF	Oh45C	R154	
A374	H45	Mo3	Oh65	R172	
A375	H46	Mo21R	Oh67	R174	
A385	H49	Mo22		R177	
A395	H50	Mo6	R2	R197	
A495	H51	Mo7	R4		
A498	H52	Mo8W		Ill.4226	
A502	H53	Mo9W	B6	Ill.A	
A509	H54	Mo10	B7	Ill.L	
A513	H57	Mo11	B8		
A547	H58	MoG	B9	SD48	
A548	H74	MoL3	B9A	SD102	
A551			B16	SD105	
A554	Ind.33-16	MS116	B18	SD107	
A563	Ind.38-11	MS211	B36		
A568	Ind.66		B41	W8	
	Ind.B164	N6	B42	W10	
Ia.1.224	Ind.Tr		B48	W32	
Ia.1234	Ind.WF9	NC7	B49	W187R	
Ia.L289			B50	W-R3	
Ia.L317	K6	ND1	B51	W37A	
Ia.Os420	K11	ND33	B52	W41A	
Ia.Os426	K41	ND203		WD	
Ia.153	K63				
Ia.I.159	K148				
Ia.I.205					

GROUP B				
A73	CI 38A	K155	Oh26A	B44
A96	CI.42A	Kys	Oh26C	B45
A116	CI.64		Oh26D	B46
A166	CI 540	Ms1	Oh26F	B47
A203		Ms12	Oh28	W33
A204	CMV3	MS24	Oh29	W59E
A208	CMD5	MS24A	Oh32	W-M13R
A238	CM145	MS206	Oh33	W103
A239		MS1334	Oh51	W182
A251	H5	MS1341	Oh51A	W22R
A259	H19		Oh56	W59M
A286	H21	NC34	Oh56A	W73
A297	H23		Oh57	W79A
A340	H28	ND5	Oh7L	R78
A344	H31	ND30	R30	R101
A347	H41	ND167	Ill.90	R112
A357	H42	ND211	Ill.5120B	R113
A392	H55	ND283	Ill.Hy	R138
A401	H56		Ill.Hy2	R158
A417	H59	NYD1100.3	Ill.M14	R159
A427	H60		SD26	R168
A508	H73	Oh02	SD104	R182[1]/
A546		Oh07	SD106	R192
A561	Ind.B2	Oh3A	W9	R194
	Ind.P8	Oh3C	W22	R196[2]/
CI.3	Ind.Pr-1	Oh3F	W24	
CI.3A		Oh3K	B10	
CI.4-8	K4	Oh7A	B14	
CI.5	K12	Oh7B	B21	
CI 21	K44	Oh7K	B37	
CI 21A	K55	Oh7N	B38	
CI.27	K64	Oh26	B43	

1/ Related to both groups, R75(WF9) and Oh51A.

2/ Related to both groups, Hy2 and R83(CI.187-2)

It was MOVED by L. H. Penny that the report be accepted.

Seconded and passed.

After the report had been accepted the question of assigning group designations to synthetics was discussed. The consensus was that this would be difficult in view of the large number of synthetics now available and their diverse origins. It was suggested that this committee undertake the listing and description of currently available synthetics including the component inbred parents.

REPORT OF THE SUB-COMMITTEE ON CYTOPLASMIC MALE STERILITY AND RESTORERS

This committee had no report to present.

REPORT OF THE SUB-COMMITTEE ON A MEETING PLACE

At the meeting of the N.C.C.B.R.C. in March 1959, there was some discussion regarding a meeting place for our group that would be less expensive.

Richard Bender of the U.S.D.A's Marketing Service suggested to M. S. Zuber the Hamilton Hotel, 20 South Dearborn, or the Midland Hotel, 172 West Adams Street.

In December 1959, D. B. Shank and Paul Crane consulted M. P. Mathewson, Vice President in charge of sales at the LaSalle Hotel. He suggested the reservation system which was used for this meeting but would not guarantee a specific rate.

Both the Hamilton and the Midland Hotels will guarantee specific rates in advance, and if a proportionate number utilize their sleeping rooms, they will provide a suitable conference room without extra charge. Their rates are as follows:

	Hamilton	Midland
Singles	$ 6.50	$ 6.00 to 10.00
Doubles	8.00	8.00 to 13.00
Twins	10.00	10.00 to 16.00

A fourth possibility is the Purdue Memorial Union which would also provide a suitable conference room and the room rates there are:

Singles	$ 5, 6, 7, 8 or 9.00
Doubles	$ 7 or $8.00
Twins	$ 7, 8 or $9.00

In view of the added travel difficulties for most conference members to reach Lafayette, the committee recommends the Hamilton Hotel for the 1961 meetings, March 1 and 2.

M. S. Zuber
D. B. Shank
P. L. Crane, Chairman

It was MOVED by Earl Leng that the report be accepted.

Seconded and passed.

REPORT OF THE SUB-COMMITTEE ON COOPERATIVE WINTER NURSERIES

Andros Island Observation

A uniform observation nursery consisting of 140 inbreds and single-cross hybrids submitted by Missouri, Illinois, Indiana, Michigan, Minnesota, and Wisconsin was grown on Andros Island during the 1959-60 winter season. The objective was to evaluate the possibility of Andros as a location for development of winter corn breeding facilities. Arrangements were made through Mr. Kenneth Parker, Parker Pen Company, Janesville, Wisconsin. Mr. Parker has an active interest in the Andros Island Company which owns 12 square miles of land on the northeast side of Andros. About 400 acres are in cultivation, mostly cucumbers this winter. Dr. Wayne Freeman, Seed Development Co., Thomasville, Georgia arranged for and supervised the actual planting.

Andros Island is the largest of the Bahama Islands owned by Great Britain. It is about 150 miles southeast of Miami, Florida and lies in the Gulf Stream. There has been no recorded frost in the history of the island. Weather records from Nassau, about 30 miles east of Andros, for 39 years list a minimum of 48°F.

Drs. Bauman, Leng and Rossman inspected the observation nursery on January 20, 1960. Most of the later maturing materials were badly infested with army worm, bud worms, etc. The early materials were relatively free of damage and were quite normal in growth. The plantation operators had sprayed every 5 days until the corn was too tall for their low ground spray equipment. Lack of a high clearance spray rig prevented further effective spraying. We felt that satisfactory corn breeding nurseries can be grown on Andros provided that suitable equipment and competent management

are available. This inspection was made 2 days before the extensive frost damage in the Homestead nurseries on January 22, 23, and 24.

A second group headed by Dr. D. L. Thompson of North Carolina State College and Dr. Wayne Freeman visited the island on January 23. They seem to concur in the above conclusion.

The soil is crushed coral rock and compares favorably with rock land in the Homestead area. A nursery facility established on Andros would have to be practically self sufficient having all its own farm equipment, high clearance spray rig, living facilities, storage, etc. There are no farmers' supply depots, machine shops, farm machinery depots, etc. Complete planning and anticipation of supplies and materials would be very essential.

Mr. Parker states that the Andros Island Co., would clear, break and crush the land and drill irrigation wells for about $250 an acre and provide 2 or 3 years rent free. He has not given me a rental figure beyond that or a purchase price.

Drs. Thompson and Freeman visited with officials of the Crown Land Office in Nassau on January 25. They reported that uncleared land could be obtained from this agency for about $30 an acre if the U.S.D.A. or an organization of state agricultural experiment stations would establish a corn breeding station on the island. The southern experiment stations seemed to be seriously interested in Andros.

Miami University Facilities

Drs. Zuber and Rossman and Charles Ford of American Maize Company visited the University of Miami Experimental Farm near South Miami. There are about 20 acres of rock land equipped with irrigation facilities that could be developed for corn breeding nurseries with some additional rock crushing costing $50-75 per acre. They have other acreage that has had less development that could be utilized but would require larger development costs. The station does not have a high clearance sprayer and would need some additional farm equipment to handle the project.

The University of Miami seems anxious to encourage additional use of the station which was granted to them on a 50 year lease from the Navy about 10 years ago. It is the location of the former Navy Blimp Station. No specific financial arrangements were presented by the superintendent--Roy O. Nelson, University of Miami Experimental Farm, Box 10151, South

Miami, Florida. Mr. Nelson suggested that some sort of a service charge proposal similar to the Homestead arrangements should be presented to Dr. W. O. Walker, Dean of Research and Industry, University of Miami, Coral Gables, Florida for negotiation.

The advantages here appear to be: (1) rock land would permit earlier planting and possibly reduce frost damage, (2) possibility of a permanent location although there are rumors that the Metro government wishes to take over the station for another airport facility, and (3) some field laboratory, storage, and greenhouse facilities. Disadvantages seem to be: (1) initial cost of equipping a nursery operation on the part of the University which has a low budget now for the station, (2) no additional frost protection over Homestead except as provided by earlier planting. (Modification of the present irrigation facility for frost protection would be possible) and (3) probably no savings in service charges compared to the present Homestead facilities.

Tampico, Mexico

Correspondence with Albert C. Novosad, Foundation Seed Stocks, Agronomy Department, Texas A & M College, College Station, Texas reports that they have been growing corn and sorghum observations near Tampico, Mexico for several years with Mr. J. C. Williamson, Rancho Santa Gertrudis, Altamira, Tamps., Mexico. Mr. Williamson is an American, capable, and progressive farmer who owns 2,000 acres of irrigated land. He has handled the cultural operations for $150 an acre. Planting has been done by Texas personnel. Mr. Novosad reports that the frost hazard is about 1-in 10 compared to 1-in 5 for south Florida.

Frost Protection Committee

An unofficial committee of industry and experiment station personnel was organized with Dr. M. T. Jenkins of Purdue Agricultural Alumni Seed Improvement Association as Chairman. This committee was organized after the frosts at Homestead to assemble, study and recommend frost protection measures that could be installed in the present Homestead nursery facilities. Two of the most discussed methods were: (1) wind tower installations costing $4,000 to $7,000 each (less if home made), and (2) mist nozzle irrigation systems for frost control. The committee plans to meet in June at the American Seed Trade Association meetings in Kansas City to prepare its report and recommendations.

Committee personnel are: Dr. M. T. Jenkins, Chairman; August Burrichter, Homestead, Florida farmer; Gene Clucas and Dr. S S. Chase, Agricultural Association; Dr. Don Duvick, Pioneer Corn Company; Paul Menge, Northrup King & Company; Dr. Wayne Freeman, Seed Development Company; Dr. D. L. Thompson, North Carolina State College; Dr. Stuart Smith, Seed Research Service; and Dr. E. C. Rossman, Michigan State University.

Recommendation

Considering all advantages and disadvantages of Florida and other possible sites, the committee recommends continuing winter corn breeding facilities in south Florida. Present operators of corn nurseries should be urged to install frost protection facilities immediately for the 1960-1961 season. Examples of wind tower protection in tomato fields and complete protection of a landscape nursery with a mist-type irrigation system are evidence that corn nurseries can probably be protected.

L. F. Bauman
E. R. Leng
M. S. Zuber
E. C. Rossman, Chairman

It was MOVED by E. C. Rossman that the report be accepted.

Seconded and passed.

REPORT OF THE SUB-COMMITTEE ON MATURITY STUDIES

1. The co-operative maturity trials between experiment station and industry corn workers were conducted in 1957 and 1958 in Minnesota, North Dakota, Iowa, Illinois, Michigan, Wisconsin, and in Ontario and Quebec provinces of Canada. A substantial body of data based on Degree-Day thermal units and involving fifty open and closed pedigree hybrids was accumulated.

2. Meeting with Industry Representatives at Madison, Wisconsin, March 20, 1959. Fifteen individuals representing Northrup King & Co., DeKalb Agricultural Association, Funk Brothers Seed Company, Pfister Associated Growers and Pioneer Hi-Bred Corn Company, together with Dr. E. H. Rinke, University of Minnesota, and University of Wisconsin personnel, met at Madison, March 20 to discuss and evaluate the co-operative trials of the 1957 and 1958 seasons.

Consideration of the data for both seasons indicates that the determination of accumulated thermal units from planting to the 40% kernel moisture stage of maturity does not provide, at present, a readily feasible method for determining a system of maturity classification of hybrid corn varieties. It is clear that substantial refinements of the procedure will be needed.

As an alternative procedure, empirical methods of maturity classifications based essentially on the 100 to 900 maturity series in each of which there would be a standard or type hybrid as used in the co-operative testing program in the North Central Region were discussed at some length. Opinions varied considerably in respect to the feasibility of such a scheme, the objective of which would be to divorce maturity from reference to a specific number of days, either implied or otherwise. Various problems in adapting it to the procedures of the several experiment stations and seed companies were mentioned. It was evident that no unanimity of opinion prevailed among those present. However, representatives of some seed companies agreed to study the proposal further and requested seed of type hybrids from each of the Minnesota and Wisconsin Experiment Stations for this purpose.

3. Co-operative maturity trials involving thermal units discontinued. In the light of the present status of the investigations and because of the lack of an immediately promising program based on accumulated thermal units that is practical and applicable to the probelm of maturity classification, it was decided unanimously to discontinue the trials.

4. Appreciation is expressed to all who have participated in these investigations. The co-operation of all participants has been excellent. It is believed that all have benefited from the venture and the discussions related thereto. Though the success for which we hoped is not immediately in sight, it is well to emphasize that the question of maturity adaptation and classification remains a major problem deserving the earnest consideration alike of the hybrid seed corn industry and Agricultural Experiment Stations.

5. The Industry representatives on the committee were:

DeKalb Agric. Assn., R. N. Rasmusen
Funk Bros. Seed Co., Ed Uchytil
Northrup King & Co., Gordon Rouse
Pioneer Hi-Bred Corn Co., M. L. Brawner
Pfister Assoc. Growers, W. R. Reid

6. The subcommittee on Maturity Ratings recommends that it be discharged.

E. R. Leng
E. H. Rinke
E. C. Rossman
Wm. Wiidakas
N. P. Neal, Chairman

It was MOVED by N. P. Neal that the report be accepted.

Seconded and passed.

Following the reports of the sub-committees there was extensive discussion of certification rules and regulations and the extent of use of open-pedigree certified hybrids.

It was MOVED BY N. P. Neal "That the North Central Corn Breeding Research Committee go on record as favoring the elimination of the specific regulation on labeling of hybrid corn". (Rules and Regulations under the Federal Seed Act, Section 201.34, those portions of paragraph 1 through 6 which pertain specifically to the labeling of hybrid corn). In practice this regulation has been completely ineffective and unenforceable. It is recommended that this proposal for elimination of the sections specified be referred to the North Central Directors for their favorable consideration and ultimate referral to the Federal-States Relations Committee.

Seconded by E. R. Leng

Passed unanimously.

The Chairman appointed a sub-committee consisting of N. P. Neal, L. F Bauman and W. A Russell (Chairman) to make a detailed study of certification programs.

The Chairman appointed a committee consisting of F. F Dicke, J. H. Lonnquist and L. H. Penny (Chairman) to submit nominations for two new members to the Executive Committee. The report of this committee to be presented at the morning session, March 3, 1960.

AFTERNOON SESSION, MARCH 2

The afternoon session was devoted to a series of topics which had been suggested to the Chairman as being of special interest to the group. Abstracts of the reports are presented in the following sections.

Interrelationships of plant populations, shading, and nitrate metabolism

R. H. Hageman and Earl R. Leng

Studies of plant population - hybrid interrelationships in corn usually indicate that different hybrids vary in their reactions to increasing populations. Invariably, increased populations produce decreased per plant yield of grain. Certain hybrids, WF9 x C103 for example, show very marked decreases in per plant yield with increasing populations, and show a high percentage of barrenness under populations in the 24,000 - 28,000 per acre range or above. Other hybrids, such as Hy2 x Oh7 or Hy2 x Oh41 are much less severely affected by the higher population rates.

Experiments by Dr. E. B Earley and others at the Illinois Station have shown that artificial shading of field-grown corn plants will produce decreases in per plant yield very similar to the effects of increasing plant populations. No firm comparisons can be made between specific plant populations and specific shading percentages. The 80% level of shading over the entire growing season almost completely eliminated grain production in WF9 x C103, while permitting low levels of grain formation in Hy2 x Oh41. The 90% shading level resulted in complete barrenness in both hybrids.

In 1959, these studies were broadened to include a time-relationship investigation. Shading levels of 0, 30, 60, 70, 80 and 90 percent shade were applied to wide-spaced plants of WF9 x C103 and Hy2 x Oh41 during the following periods:

Shade period

(1) Emergence to 2 weeks before silking time
(2) 2 weeks before silking to 1 week after silking
(3) One week after silking to harvest

Shading period (1), at the higher shading levels, produced stunted plants which, however, bore fair-sized ears. In shading period (2), the 90% shading level virtually eliminated ear production in both hybrids. At the 80% shading level, Hy2 x Oh41 produced small ears, but WF9 x C103 was almost completely barren. Shading period (3) affected kernel filling, but ear size was otherwise nearly normal.

These observations have indicated that one or more light-conditioned physiological processes are importantly involved in reduction of grain production on shaded (or crowded) plants. Attention was directed toward the activity of the enzyme nitrate-reductase as one possible metabolic step which might be involved. Studies at Illinois have shown:

(1) Nitrate reductase activity is directly related to light, in the sense that this activity declines during dark periods, and is almost completely eliminated by retaining plants in darkroom conditions for 96 hours. Restoration of light results in a sharp increase in activity of the enzyme.

(2) Nitrate reductase activity is also dependent on nitrogen supply.

(3) The hybrid Hy2 x Oh7 has a considerably higher level of nitrate-reductase activity than does WF9 x C103, under all test conditions employed.

(4) Leaf samples from plant-population show higher levels of nitrate-reductase activity, lower levels of nitrate, and higher levels of soluble protein in lower planting rates than in higher rates.

(5) Nitrate-reductase activity in field-grown shaded plants decreases with increased shading levels Hy2 x Oh41 retains higher activity levels than WF9 x C103 at all shading degrees except the 90% treatment, where activity in both hybrids was found to be very low.

(6) Other major enzymes studied do not show the drastic reductions in activity under shading or dark conditions which have been observed for nitrate-reductase.

Further studies are in progress to test the working hypothesis that interference with nitrogen metabolism is a major cause of decreased per plant yields as plant populations are increased.

A New Bacterial Disease of Corn Occurring Under Irrigation in Wisconsin

Paul E. Hoppe and Bertie B. Griffiths

An extremely severe soft-rot disease of corn, incited by a bacterium carried in overhead irrigation water, was found June 30, 1959 near Lone Rock, Wisconsin. Plants were knee-high and taller when the disease first was seen. About 10 percent of the plants in a 14-acre field eventually were killed following three separate irrigations.

Symptoms. Infection started at the base of the whorl from where a soft-rot developed downward through the stalk, resulting in collapse and early death of the plant. An unique symptom of this disease was that the tops of infected plants always could be lifted out, exposing a soft-rotted condition above and beneath the breaking point which occurred near the terminal growing point.

Isolation of bacterium and soft-rot tests. A bacterium isolated from diseased plants proved capable of causing soft-rot in carrot, onion, and corn stalk tissues in Petri plate tests. In parallel tests with Erwinia carotovora, E. aroideae, and E. atroseptica, these well-known soft-rot pathogens rotted carrots and onions but failed to attack the corn.

Field inoculations. Symptoms identical with those observed in the diseased field at Lone Rock were obtained five days after healthy corn plants were inoculated by pouring 5-10 cc of water suspension of the isolated bacterium into the whorl of plants. Inoculum injected hypodermically into stalks resulted in rapid soft-rot development, with stalks broken over three days after the inoculations were made. None of the Erwiniae caused disease following these methods of inoculation.

Evidence of natural spread of the disease from plant to plant was found only in the field where inoculations were made.

Greenhouse inoculations. The corn pathogen was found pathogenic to corn seedlings after 30 or more consecutive single-colony transfers.

Identity of the pathogen. This bacterium has been identified as one belonging to the coliform group. We tentatively are calling it Escherichia maydis. This is believed to be the first reported instance of a bacterium of the coliform type being highly pathogenic to plants.

Interactions Involving Cytoplasmic Male Sterility, Fertility Restoring Genes, and Environmental Factors

Jack B. Beckett

The sources of male sterile cytoplasm tested to date appear to fall into five different groups. Each group responds to a different set of restorer genes, so far as is known, but all appear to respond alike to environmental changes. Only the USDA (or S) and Texas sterile cytoplasms will be discussed here, as they have received the most study.

Inbreds vary in their ability to restore fertility in the presence of a specific sterile cytoplasm. Some remain sterile under all conditions, others restore full fertility, and still others produce varying degrees of fertility, depending on environmental conditions. Because of differences in environment, a series of plantings from a single lot of seed will often give widely varying percentages of fertile, partially fertile, and sterile plants.

With few exceptions, the evidence indicates that any tendency toward anther exsertion and pollen production is accentuated by moist soil and high humidity at and just preceding silking time; dry soil and low humidity at this time reduce the level of fertility.

Dr. Duvick of Pioneer has demonstrated that the addition of nitrogen fertilizer reduces the level of pollen fertility in the presence of both USDA and Texas sterile cytoplasms. In addition, there is some evidence that potassium fertilization may tend to increase male fertility. The effect of daylength has not been determined with any degree of certainty. It is probably less important in affecting fertility than varying moisture and nitrogen levels.

For Texas sterile cytoplasm, a single dominant fertility-restoring gene ($\underline{Rf_1}$ on chromosome 3) is required by most inbreds for the expression of full fertility. The inbred WF9 requires, in addition, a dominant complementary gene.

As backcrossing programs designed to incorporate $\underline{Rf_1}$ into existing inbreds (in the presence of Texas cytoplasm) have proceeded, it is becoming evident that additional genes, usually dominant modifiers and sometimes apparently additive in effect, are required by many inbreds for the expression of full fertility. When these modifiers are lost in the course of backcrossing, the level of fertility may be unaffected

under cool, moist conditions, as in the greenhouse or the Florida winter nursery, but reduced or even complete male sterility may result under the less favorable conditions of the midwest.

It may be concluded, therefore, that presumably sterile versions of inbreds and single crosses should be screened in Florida winter nurseries, preferably under low nitrogen conditions, where any tendency toward fertility will be expressed. Conversely, restored single and double crosses, and material into which restorer genes are being incorporated, are best tested in hot, dry situations, with an ample supply of nitrogen provided, to make certain that satisfactory pollen shedding is obtained. This latter test is particularly important for material which gives any hint of reduction in fertility during the course of backcrossing.

Stalk Rots - Our Current Knowledge of Stalk Rots of Corn

A. L. Hooker

Stalk rots are the most serious group of diseases of dent corn in the Corn Belt. Amount of loss varies widely with locations, years, cultural practices, hybrids, and other factors.

Stalk rots may be caused by ten or more species of fungi and several species of bacteria. Of these Diplodia zeae is most common in Illinois and adjoining states on the east and west. Gibberella zeae, although prevalent in this region, is more common in the states to the north and east. Sclerotium bataticola (Macrophomina phaseoli) causing charcoal rot is more damaging in the drier western part of the Corn Belt.

Stalk rots cause direct losses in yield amounting on the average to 10% over large areas and higher in individual fields. Stalk rots are responsible to a large degree for broken stalks and lodged corn resulting in harvest difficulties, harvest losses, and increases in ear rots.

Natural stalk rot epiphytotics are influenced by weather conditions, resistance of hybrids, maturity of hybrids, yield potential of hybrid, leaf damage from leaf blights and other causes, soil fertility, planting rate, and other factors.

Methods for artificial inoculation have been developed for Diplodia and Gibberella stalk rot. Spore suspensions injected into the stalk are widely used for Diplodia. Mycelial or sporulating cultures growing on toothpicks, pipe cleaners, or grain and placed into the stalk have worked

well for Gibberella or Diplodia. Inoculations should be made from 0 to 10 days after pollination. The first elongated internode above the ground appears to be the best site for inoculation. Disease scores should be taken at least 3 or 4 weeks after inoculation or at harvest. Scores can be based on premature killing, surface discoloration, or more critically on the area involved by the rot when stalks are split. In most cases resistance to Diplodia is associated with resistance to Gibberella. Results from artificial inoculations have been reliable in determining reaction to stalk rots and in the practical development of stalk rot resistant inbreds and hybrids. Ratings of stalk rot reaction resulting from natural infection can be taken on the bases of premature killing, broken stalks, firmness of stalks, surface discoloration and presence of fruiting structures, or internal discoloration.

Little data is available on the inheritance of stalk rot reaction. That available suggests quantitative inheritance. Observations indicate that some inbreds may be more effective than others in transmitting resistance to hybrids.

Several reports on the nature of resistance to stalk rot have been made. There is evidence of an ether- on sap-soluble substance which is inhibitory to the growth of Diplodia and Gibberella in culture. The amount or activity of this substance is equal in all strains up to pollination, but as ears develop susceptible lines lose this growth-retarding effect more rapidly than do resistant lines. Stalk rot reaction has been positively correlated with nitrogen content and negatively correlated with sugar, cellulose, ash, crude fiber, and lignin content. There is no evidence of mechanical barriers inhibiting fungus spread. Recent evidence indicates that the spread of Diplodia in the corn plant is determined by the physiological state of the invaded cells. Physiologically active cells inhibit the spread of the fungus while senescent cells do not. Histological studies support this hypothesis. There is a positive correlation between density of stalk pith and resistance. Pith tissues of low density had a high percentage of dead cells and was susceptible to Diplodia. Trends of sugar content in the stalk were more closely associated with resistance to Diplodia than were total sugars. Downward trends after pollination were characteristic of susceptible lines and upward trends were characteristic of resistant lines. The developing ear has first priority on sugars produced in the plant. If sugar supply is not sufficient for both grain development and vegetative cell maintenance, grain formation is accompanied by a reduction in the physiological activity of vegetative cells. This results in stalks and roots susceptible to infection. If downward trends in sugar content of the stalk indicate greater grain production, the ultimate in stalk rot resistance may not be compatible with the ultimate in grain yield.

Proposed Studies on Stalk Rots

M. S. Zuber

One of the major problems that has confronted our work with stalk rots at the University of Missouri is the failure to obtain consistent results for different years. These inconsistencies could be due to the techniques employed, sources of stalk rot isolates by environment interaction, and stalk rots caused by natural infection. This would be especially true if the natural infection gave different results than those obtained from artificial infections or if the stalk rot was caused by an organism different than the one employed.

No doubt, many studies have been conducted on techniques employed for inoculation with stalk rots. It is possible sufficient data have been accumulated on these various techniques, and if such be the case, it would be very beneficial to have such data summarized and evaluated. From these data, a uniform, standard set of techniques might then be recommended and employed. For example, some investigators recommend the use of the toothpick, others the hypodermic needle and some the jabbing of a nail into infected soil before injecting into the stalk. Likewise differences exist, concerning the best time to inoculate and to make the stalk rot ratings. The recommended place of inoculation has not been established to our satisfaction whether it be the first, second or third internode above the soil level or below the soil level.

For many years, at Missouri, plants in the breeding nursery were inoculated as soon as hand pollinations were completed, usually 10 to 25 days after flowering. The readings were made whenever it was convenient in the fall. In 1958, separate plantings of inbred lines were made for inoculation purposes. Starting last year, more attention was given to the time of inoculation and to the time of making readings. Dates were recorded when an inbred was 50% silked, and Diplodia inoculations were made 20 days later. Likewise, stalks were split and readings were made as close as possible to 30 days after inoculation. From experiments set up for another purpose, and employing a range of dates, we arrived at the conclusion that this system gave us the best results.

A number of inbreds were mass inoculated, in 1958, with no attention given to maturity. Readings were made in the same manner. From this group, 158 lines were classified as extremely susceptible and 164 lines as resistant. These same inbred lines were grown in 1959, and

inoculated with Diplodia to check repeatability. Among the susceptible group, 75% were classified again as susceptible and 2% as resistant. Among the resistant group of 164 lines, only 20% were in the resistant class and 45% were in the susceptible class. The repeatibility for the susceptible group was much higher than for the resistant group. Poor repeatability was, in part, attributed to the different techniques employed in 1958 and 1959, however, the organism by environment interaction can not be ruled out, as the sources of the isolates used each year were different and the growing conditions of the 2 seasons were dissimilar. The inoculum used was usually a mixture of about 15 to 20 isolates taken from Diplodia infected ears and stalks collected throughout the State.

In suggesting proposed studies on stalk rots, it is realized that much research on these particular aspects may have been conducted, some published and some not, and since the lack of time did not permit me toreview the current work adequately, or send out inquiries to obtain additional information, I trust you will take this into consideration on the proposed studies I have outlined. These proposed studies can be classified in four groups, (1) Technique, (2) Environment, (3) Inheritance, and (4) Mechanisms of Resistance.

I Technique:

A. Comparison of the method of infection (toothpick, hypodermic needle, nail, etc.)

B. Determine the best time of infection whether it be (5, 10, 30, 40 or 50 days after flowering)

C Establish a standard method of rating (similar to leaf blight, for example)

D. Determine the best time of rating after inoculation (20, 30 40 days after inoculation, or the mature plant stage)

E. Place of infection (1st., 2nd., 3rd., internodes above the soil level, or possibly below the brace root level)

II. Environment:

A. Investigate the interaction of single isolate sources by locations and by years; interaction of mixed isolate sources by locations and by years.

B. Determine the effect of ranges in moisture, temperature, light and nutrient levels on growth of specific isolates.

C. Make climatological and ecological studies on the effect of the growing season on stalk rots.

D. Correlate the relationship between artificial and natural infections.

E. Determine the influence of other corn diseases on stalk rots such as leaf blight as an example.

III Inheritance:

A. Resistance studies such as locating specific genes, number ofgenes.

B. Invesigate the isolate - host specificity (in other words, do some inbreds show more resistance to a given isolate than others?).

C. Study the genetic variability of different isolates.

D. Determine the stability of different isolates from year to year.

IV. Mechanism of Resistance:

A. Investigate the chemical phase: for example, nitrogen - carbohydrate ratio of stalks. This ratio might be changed by fertilizer application, plant densities and high yields.

B. Investigate the physical aspect such as stalk morphology.

C. Compare growth rates of different isolates when culture media is fortified with plant sap from resistant and susceptible strains of corn.

It is possible that other studies might be added to this group but I feel that if we knew the answers to the ones just listed, we would be on the way to solving some of the stalk rot and stalk lodging problems which confront us at the present time.

In my opinion, we can gain a lot of valuable information on stalk rots by initiating a cooperative study without delay. I have drafted preliminary plans for such a study which I would like to submit to this conference for consideration. If it appears worthy to the group, and

operational, I would propose, Mr. Chairman, that a committee of 4 be appointed to further investigate and iron out the details for this proposal. I would further recommend that the chairman of this committee be a Pathologist and the other three members represent the three groups of maturity classes as outlined in this proposal.

The proposal of M. S. Zuber to have a committee consider stalk rot problems and develop plans for cooperative studies was accepted by the Chairman and a committee consisting of Paul E. Hoppe, M. S. Zuber and A. L. Hooker (Chairman) was appointed.

MORNING SESSION, MARCH 3

The first order of business was the report of the Nominating Committee. Their nominations for new members of the Executive Committee were Wm. R. Findley, Jr., and E. J. Dollinger. There were no nominations from the floor.

It was MOVED by A. L. Hooker that the Secretary be instructed to cast a unanimous ballot for the proposed slate.

Seconded and passed.

The next order of business was the presentation and consideration of reports for the various maturity series.

REPORT OF THE SUB-COMMITTEE ON THE 900 MATURITY SERIES

Results from the 900 maturity double cross trials conducted in 1959 are summarized in Table 1. Two-year data are presented in Table 2. Summaries of the yellow and white three-way cross trials conducted in 1959 are summarized in Tables 3 and 4.

Yellow and white three-way crosses were produced in 1959 for regional testing in 1960. The yellow combinations involving WF9 x T8 as tester parent were produced by Missouri and Virginia. White three-way crosses involving Ky21 x 33-16 as tester were made by Kansas and Kentucky. The following crosses are available for 1960 uniform tests:

(WF9 x T8)R115	(WF9 X T8)Mo 53682	(WF9 x T8)Mo 61012
" R204	" Mo 11153	" Mo2788B
" R205	" Oh 13	" Mo 3948
" R206	" Va 21	" Mo 9294
" R207	" Va 22	
" K8031	" C103(Va)	
" Ky 108	" Mo J.S. 1	
" Ky 120	" Mo J. W.	
" Ky 127	" Mo J.L.O.	
" Ky 57-571	" Mo J24	
" Ky 57-573	" Mo J.K.B.	
" Ky 57-565	" Mo J. 52	
" Ky 57-582	" Oh 41	
" Ky 57-610	" CI.21E	
" Ky 57-619	" CI.38B	
" Ky 57-649	" 38-11	
" Ky 57-683	" CI.21E x CI.42A	

Ky 105 (T8 x CI.21E)(38-11 x Oh 7B)
Mo 916 (Mo 6 x CI.21E)(Oh 29 x Oh 7B)
V.P.I. 646 (WF9 x T8)(38-11 x C103)
K4003 (K713 x K711)(K712 x Oh7B)

Kentucky will distribute seed for the white 3-way cross trials which was produced by the Kentucky and Kansas Agricultural Experiment Stations. Thirty-three items to be tested in 1960 are:

(Ky 211 x 33-16) K6555	(Ky 211 x 33-16) Ky 57-256
" K6558	" Ky 57-260
" K6656	" Ky 57-264
" K7526	" Ky 57-281
" K7654	" Mo 1913W
" K7665	" Mo 11768W
" Ky 215	" Mo 11496W(A)
" Ky 57-169	" Kans 48:OP90-11-1-1-1
" Ky 57-188	" Kans 48:OP90-8-1-2-1-1
" Ky 57-192	" H30
" Ky 57-201	" K55
" Ky 57-212	" Ky 27
" A13-1	" K64
" F163	" H21
" Ky 57-242	" Ky 209
" Ky 57-252	US 523W (K55 x K64)(Ky 27 x Ky 49)
" Ky 57-253	

Yellow 3-way cross seed for the 1961 trials will be made by Missouri and Virginia using B41 x Ky 36-11 as tester.

Inbred	Origin	Nominated by
K9022	Midland	Kansas
R134	(Mo2RF x K201)Mo 2RF	Illinois
R196	Hy2 x R83	Illinois
T218	T13 x CI.7	Tennessee
T222	[T111(RB893 x RB751) T11]	Tennessee
T224	[T115(I205 x L289)]T115	Tennessee
T458	T115(RB893 x RB751)	Tennessee
T474	T107(M14 x Oh51)	Tennessee
T490	T109 (RB.L x RB 751)	Tennessee
T498	T109(RB893 xRB751)	Tennessee
A441-5	Robyn x Leaming	Tennessee
Va 17b	WF9 x T8	Virginia
Va 9709	(C103 x T8)T8	Virginia
CI.44		Missouri
Mo 0225	Mp H.Y.D./T8	Missouri
Mo 6	Midland/T8	Missouri
CI.21E	Standard	
T8	Standard	
CI.38B	Standard	
K713 (K201G)	Standard	Seed to be supplied by Kansas
AKd 26	R40 x Hy	Arkansas
AKd 28	Kys x R40	Arkansas

White 3-way cross seed for the 1961 trials will be made by Kentucky and Kansas using Ky211 x 33-16 as tester. Fifty kernels of the following nominated lines should be sent to F. A. Loeffel and W. R. Findley.

Inbred	Origin	Nominated by
T115	Jellicorse	Tennessee
T315	T111 x (RBL x I11A)	Tennessee
T331	T113 x (I205 x L289)	Tennessee
T357	T115 x (RB893 x RB751)	Tennessee
E 184	Kansas 2234	Tennessee

Inbred	Origin	Nominated by
K8425	(CI.61 x K148)S_7	Kansas
K9515	T. C. K2275 x B3'(S_4)	Kansas
Mo 11474W	K10 x K64	Missouri
CI.66	Standard	
K6	Standard	
CI.64	Standard	
Ky 27	Standard	

900 Maturity Uniform Trials 1960

The following states plan to grow the specified trials listed below:

State	Yellow 3-way	White 3-way
Oklahoma	+	-
Virginia	+	-
Kansas	+	+
Illinois	+	-
Nebraska	+	-
Missouri	+	+
Kentucky	+	+

Table 1. Summarized performance of uniform 900 maturity series AES hybrid candidates-1959. (grown near Manhattan, Kansas; Hopkinsville and Lexington, Kentucky; Brownstown and Wolf Lake, Illinois; Paradise and Stillwater, Oklahoma; Huntsdale, Missouri; and Holland, Virginia).

	1/	2/	2/	2/	2/	2/	3/	2/	4/	5/	6/
	Acre yield	Acre yield	Moisture at harvest	stand	Lodging root	Lodging stalk	Dropped ears	Ear ht.	Helminthosporium turcicum	Helminthosporium maydis	Corn borer
	Bu.	Bu.	Pct.	Pct.	Pct.	Pct.	Pct.	Gr.	Rating	Rating	Rating 1-9
Ark.5614(CI.7 x Ak8)(Ak120 x C103)	81.7	90.4	17.5	93	2	22	3	3.7	2.3	2.5	7.3
Ga.7009(GE54 x C103)(NC88 x GE62)	----	98.4	19.3	92	2	17	1	3.9	1.8	2.0	5.7
Ill.3355(R71 x R109B)(H49 x H51)	----	96.2	16.4	93	2	14	3	3.2	2.8	1.8	6.3
Ill.3360(R101 x Oh41)(H49 x H51)	----	93.3	16.3	93	1	18	4	3.3	2.5	2.5	6.3
Ill.3362(H49 x H51)(Oh7 x CI.42A)	----	97.4	16.5	94	1	15	1	3.8	2.0	2.5	6.3
K2446W(K55 x 33-16)(K41 x H30)	93.2	102.4	16.9	95	3	21	3	3.6	2.5	4.0	6.3
K2561W(K55 x Mo.1W)(H28 x H30)	88.7	99.8	16.5	93	5	19	1	3.4	2.8	3.5	7.0
K4003(K201R x K711)(K712 x Oh7B)	96.8	104.3	17.3	93	4	18	0	4.0	2.3	1.8	5.0
Ky5708(CI.38B x CI 29C)(C103 x CI.21E)	65.5	73.2	16.9	92	2	26	3	3.4	2.8	2.3	7.0
Ky5712W(CI.64 x 33-16)(K55 x Ky201)	91.2	97.4	17.8	92	2	9	2	3.5	3.0	1.5	6.7
Mo.881(Oh7B x Oh29)(Mo.7 x CI.21E)	91.7	103.2	17.0	83	4	11	0	4.0	2.8	2.0	5.7
Mo.916(Oh7B x Oh29)(Mo.6 x CI.21E)	80.9	88.9	17.8	65	1	6	1	3.0	2.3	2.8	7.0
NC5113(CI.21E x AS13B)(BD1 x AS21A)	87.4	97.3	18.0	95	3	13	2	3.1	2.5	3.0	6.3
Tenn.501(T115 x T111)(K41 x K44)	89.8	99.6	18.3	94	1	20	4	3.6	2.5	2.3	7.1
T5005(T474 x T490)(T218 x T220)	92.1	99.8	16.7	96	2	25	0	4.2	3.0	2.3	6.3
T7015(T474 x T490)(A441-5 x Ky36-11)	94.8	103.4	17.8	97	3	31	1	4.2	2.3	2.3	6.0
T7018(T474 x T490)(ITE701 x Ky36-11)	92.1	99.0	16.4	99	1	30	0	4.4	2.3	2.5	7.3
T7110(T315 x T337)(E184 x K64)	----	109.1	17.2	93	3	14	1	3.7	2.5	1.0	6.7
T8106(T331 x T315)(A14 x T115)	----	102.7	17.7	93	2	18	1	3.6	2.5	4.0	6.3
VPI648(WF9 x T8)(Hy3 x C103)	87.5	92.9	17.4	93	1	8	3	3.5	2.5	2.0	7.0
VPI653(WF9 x T8)(Oh43 x K155)	85.7	90.6	16.9	96	1	11	3	3.5	2.3	2.3	5.7
U.S.640(CI.20 x T202) x(CI.42A x CI.90A)	----	102.2	17.5	97	2	23	1	4.0	2.0	1.5	6.7

Table 1. (cont'd.)

	1/	2/	2/	2/	2/	2/	3/	2/	4/	5/	6/
	Acre Yield	Acre Yield	Moisture at Harvest	Stand	Lodging		Dropped ears	Ear Ht.	Helminthosporium		Corn Borer
					Root	Stalk			turcicum	maydis	
	Bu.	Bu.	Pct.	Pct.	Pct.	Pct.	Pct.	Gr.	Rating	Rating	Rating 1-9
U.S.642(CI.42A x CI.90A)(CI.20 x CI.317B)	----	101.7	17.4	96	2	28	4	4.0	1.8	1.8	7.3
U.S.648(CI.20 x CI.42A)(T498 x T432)	----	95.3	16.2	96	1	17	3	3.5	2.3	1.8	7.0
U.S.658(CI.7 x CI.90A)(CI.20 x CI.38A)	----	98.2	17.3	94	3	23	3	3.8	2.0	2.0	7.0
U.S 423W(K55 x K64)(Ky27 x Ky49)	94.5	104.6	17.3	95	3	22	0	4.0	2.3	3.3	6.7
Ky105(T8 x CI.21E)(38-11 x Oh7B)	96.5	105.1	16.9	96	0	13	1	4.0	2.5	2.0	5.0

1/ Data from all 9 locations.
2/ Data from Manhattan, Kansas; Hopkinsville and Lexington, Kentucky; Huntsdale, Missouri; and Holland Virginia only.
3/ Data from Manhattan, Kansas; Lexington, Kentucky; and Huntsdale Missouri only.
4/ Data from Lexington, Kentucky only.
5/ Data from Hopkinsville, Kentucky only.
6/ Data from Ankeny, Iowa only.

Table 2. Summarized performance of 900 maturity series AES hybrids and candidates. Average 1958 and 1959.

Hybrid designation	Acre Yield	Moisture	Stand	Lodging		Dropped ears	Ear height	Corn Borer (1-9)	Hel. tur.	1/ Hel. maydis	2/ Smut	Grain Quality
				Root	Stalk							
	Bu.	Pct.	Pct.	Pct.	Pct.	Pct.	Grade	Rating	Rating	Rating	Pct.	Score
K4003	103.8	19.8	95	4	14	0.0	4.1	5.9	2.7	1.8	3	3.7
Ky5708	86.6	18.9	95	2	15	2.6	3.7	6.5	2.2	2.3	5	3.6
Ky5712W	100.4	19.4	95	2	6	1.2	3.6	6.7	2.9	1.5	6	3.3
U.S.523W	103.9	19.5	96	4	14	0.5	4.0	7.2	2.4	3.3	3	3.4
Ky105	103.3	19.0	95	2	9	1.5	4.1	6.4	2.7	2.0	10	3.9

	Pedigree
K4003	(K201G x K11)(Oh7B x K12)
Ky5708	(CI 29C x CI.38B)(C103 x CI.21E)
Ky5712W	(CI.64 x 33-16)(K55 x Ky201)
U.S.523W	(K55 x K64)(Ky27 x Ky49)
Ky105	(T8 x CI.21E)(38-11 x Oh7B)

Table 3. Summary of performance of uniform 900 maturity series yellow 3-way hybrids - 1959.

Rank	Hybrid (B41 x Oh7A) x	Yield 1/ Ill.	Kan.	Ky.	Mo.	Okla.	Va.	Ave.	Moisture at Harvest /2	Lodging Root % /3	Lodging Stalk % /3	Erect % /4	Stand % /1
1	Mo.0225	117	84.5	100.8	78.9	79.6	128.1	98	25.7	5	8	89	96
2	Mo.6 (Mo.9108	112	89.4	98.0	77.7	64.9	125.3	95	19.3	2	12	79	94
2	Ok.4002	105	84.9	101.6	82.0	72.3	122.4	95	18.4	6	27	76	95
2	Va.35C	114	86.2	101.1	79.8	65.6	119.9	95	18.7	4	8	85	96
5	Va.27	117	91.2	93.0	80.4	63.4	121.1	94	18.8	2	18	67	96
6	Va.29	118	73.7	107.4	77.7	55.2	121.7	92	22.9	7	25	69	91
6	Ok.7001	115	87.9	91.4	82.6	67.4	106.6	92	18.3	1	27	64	93
6	R134	113	88.7	97.2	78.5	57.2	114.9	92	19.1	3	16	72	96
9	CI.31A	109	80.0	94.9	75.1	66.8	112.9	90	19.9	4	13	80	94
10	Ok.4003	103	80.6	95.4	71.5	68.8	116.9	89	19.6	7	45	52	95
10	Ok.7002	92	83.5	93.2	86.6	50.8	101.2	89	17.4	2	37	51	96
12	K7-25	99	82.4	93.5	89.3	68.6	97.0	88	18.7	7	23	71	96
12	Ok.2011	110	79.5	100.2	83.6	47.0	110.7	88	19.5	7	41	51	94
14	Va.12C	102	78.2	97.4	66.0	61.3	115.7	87	19.1	3	6	90	93
14	Mo.61072	107	83.3	87.1	71.0	78.3	96.9	87	19.8	1	7	92	95
16	Mo.7 (Mo.999	99	83.1	98.5	70.8	54.5	112.7	86	20.4	4	18	58	95
16	Ok.2012	106	79.7	90.3	78.6	56.8	106.7	86	20.2	6	32	54	93
16	Ok.4001	98	80.8	101.7	55.8	57.8	119.2	86	19.1	5	28	61	92
19	Mo.11077	115	75.5	87.7	63.3	68.8	99.1	85	19.3	3	8	68	96
20	Va.23	89	82.4	88.4	77.7	57.6	109.8	84	19.5	3	21	78	94
20	Mo.9294	106	66.8	90.1	66.3	67.3	109.2	84	19.9	1	22	61	95
20	Mo.5	92	84.4	84.6	78.5	62.0	94.7	84	18.5	3	14	68	95
20	R197	104	78.7	91.8	77.0	48.8	101.6	84	18.2	5	27	61	94
24	K7-47	110	78.2	84.4	66.2	59.5	97.8	83	20.0	1	27	71	94
25	Ok.2013	85	78.4	87.5	77.7	60.1	102.7	82	20.3	7	15	79	94
26	K7-50	104	74.1	82.2	77.2	50.5	98.5	81	17.8	2	20	72	93
26	R198	101	78.5	89.9	73.3	41.1	99.1	81	19.0	5	33	46	97
28	Mo.2788A	91	80.4	87.2	64.9	64.2	94.3	80	19.4	3	20	50	91
29	K7-27*		74.5	100.5	81.9	60.0		79	18.9	5	25	62	91
30	R132	93	85.5	79.5	67.0	57.5	86.9	78	17.6	1	36	56	96
	Mean	104.3	81.2	92.9	75.2	61.1	108.4	87	19.4	4	22	68	94

Table 3. (cont'd.)

Rank	Hybrid (B41 x Oh7A) x	Days to 50% Silk /5	Grain Quality Score /6	Ears Per 100 Plants /7	Shelling % /8	Ear Height Ft. /9	Drop Ears % /8	Smut % /8	H.May. Score /10	H.Tur. Score /11	Stewarts Score /10	Corn borer rating 1-9 leaf feeding /12
1	Mo.0225	68	2.8	106	78	3.3	4	5	1.1	1.8	4.5	5.7
2	Mo.6 (Mo.9108	67	3.2	108	79	3.5	1	5	1.9	2.3	4.1	7.3
2	Ok.4002	70	2.8	111	80	3.7	1	5	2.6	2.0	3.4	4.7
2	Va.35C	65	2.8	100	79	3.3	2	1	1.4	2.3	3.9	6.3
5	Va.27	66	3.4	111	79	3.2	2	0	2.0	2.3	3.6	5.0
6	Va.29	70	2.3	100	81	3.5	4	0	3.0	2.5	2.6	6.7
6	Ok.7001	67	3.0	98	80	3.6	1	5	1.6	3.0	3.7	5.3
6	R134	65	3.1	100	79	3.3	5	0	2.4	2.3	3.6	7.7
9	C1.31A	67	2.7	106	80	3.4	1	4	1.7	2.0	4.0	4.7
10	Ok.4003	67	3.4	114	81	3.4	0	1	2.4	3.8	4.1	4.7
10	Ok.7002	66	3.0	101	81	3.5	5	4	2.0	3.5	3.2	6.7
12	K7-25	66	1.8	101	78	3.2	1	0	1.7	3.3	3.5	6.7
12	Ok.2011	65	2.8	101	82	3.2	16	4	2.9	2.5	3.2	7.0
14	Va.12C	67	2.9	100	74	3.5	1	4	2.2	1.8	2.5	7.0
14	Mo.61072	67	2.7	101	80	3.2	0	2	2.3	3.5	4.0	8.0
16	Mo.7 (Mo.999	68	2.4	102	78	3.8	0	8	2.0	2.8	3.9	7.0
16	Ok.2012	67	2.9	104	81	3.5	4	3	3.0	2.3	3.4	5.7
16	Ok.4001	68	3.1	110	80	3.4	0	2	2.0	2.3	3.3	5.3
19	Mo.11077	67	3.0	98	86	3.3	3	3	1.6	2.0	3.7	8.3
20	Va.23	65	2.6	100	80	3.0	0	3	1.9	3.5	2.9	5.0
20	Mo.9294	69	3.0	99	80	3.4	1	4	2.7	2.5	4.3	7.3
20	Mo.5	66	2.6	103	78	2.7	0	8	2.6	3.5	3.1	7.3
20	R197	65	2.8	109	82	3.3	5	2	1.7	2.8	3.9	7.0
24	K7-47	66	3.4	97	81	3.3	0	10	2.6	2.3	4.0	6.3
25	Ok.2013	64	3.3	102	80	3.3	1	5	2.2	2.0	3.5	7.3
26	K7-50	66	3.5	93	85	2.9	2	4	2.4	2.8	3.9	5.3
26	R198	67	2.9	97	83	3.4	13	4	2.0	2.3	3.4	6.7
28	Mo.2788A	67	3.5	97	76	3.2	0	2	2.0	3.5	3.9	6.3
29	K7-27*	64	3.4						2.7	2.5	2.8	7.0
30	R132	67	2.7	92	82	3.1	0	3	2.6	2.8	4.1	9.0
	Mean	67	2.9	102	80.1	3.3	3	3	3.3	2.6	3.6	6.5

Table 3. (cont'd.)

* Not grown in Illinois and Virginia tests.
1/ Data from Brownstown, Ill.; Manhattan and Liberty, Kan.; Hopkinsville and Lexington, Ky.;Columbia, Mo.; Stillwater and Paradise, Okla.; Blacksburg and Holland, Va.
2/ Data from Brownstown, Ill.; Manhattan and Liberty, Kan.; Hopkinsville and Lexington, Ky.; Columbia, Mo.; Blacksburg and Holland, Va.
3/ Data from Manhattan and Liberty, Kan.; Hopkinsville and Lexington, Ky.; Columbia, Mo.; Blacksburg and Holland, Va.
4/ Data from Brownstown, Ill.; Hopkinsville and Lexington, Ky.; Stillwater and Paradise, Okla.
5/ Data from Manhattan and Liberty, Kan.; Stillwater and Paradise, Okla.; Blacksburg and Holland, Va.
6/ Data from Lexington, Ky.; Stillwater and Paradise, Okla.; Blacksburg and Holland, Va.
7/ Data from Blacksburg and Holland, Va.
8/ Data from Brownstown, Ill.
9/ Data from Brownstown, Ill.; Hopkinsville and Lexington, Ky.
10/ Data from Hopkinsville and Lexington, Ky.
11/ Data from Lexington, Ky.
12/ Data from Ankeny, Iowa

Table 4. Summary of performance of uniform 900 maturity series, white three-way hybrids - 1959.

Pedigree	Acre yield bu. 1/	Moist. at harv. % 2/	Lodging Root % 2/	Lodging Stalk % 2/	Dropped ears % 2/	Ear ht. ft. 2/	Foliar Disease grade may 3/	Foliar Disease grade tur 3/	Foliar Disease grade Stewarts 3/	Maturity Date Silk 4/	Corn Borer rating 5/	Ear Appear. rating 6/	Stand % 1/	Erect Plants % 7/
(K55 x CI64)33-16	95.1	16.2		11.3	0.7	3.8	1.4	1.8	3.1	57	7.7	2.5	95.3	83.0
" H30	88.0	15.7	0.4	9.3	0.2	3.5	2.4	1.8	3.7	58	7.0	3.2	93.6	71.5
" Ky 27	93.2	15.9	0.6	17.7	0.2	3.7	1.2	1.3	3.0	58	7.0	2.7	92.7	65.0
" Ky 49	103.2	17.9	0.3	6.6	0.4	3.9	1.8	1.7	3.3	60	7.7	3.0	94.8	73.0
" CI49B	86.1	17.9		9.6	0.5	3.7	1.2	1.4	2.8	61	8.0	3.5	93.9	75.0
" K735	92.9	17.5	0.5	5.3	0.6	3.5	1.0	1.5	2.8	57	7.0	2.8	94.0	67.5
" K776	87.0	16.3	1.5	9.0		3.5	1.7	1.9	3.2	56	4.3	2.8	94.7	75.5
" K789	90.9	17.2	0.2	5.1	0.1	3.4	1.6	1.5	2.8	59	7.3	3.1	94.7	76.0
" K790	89.3	15.6		2.6	0.1	3.8	1.2	2.2	2.6	58	6.3	3.1	95.4	84.0
" K791	94.3	16.5	0.2	8.2	1.5	4.1	2.7	1.9	4.2	59	6.3	2.4	95.2	73.0
" K7-526	100.3	17.9	0.5	4.8		3.5	1.2	1.7	3.4	60	6.3	2.3	96.6	82.0
" K7-540	89.6	16.2	1.5	10.5		3.1	1.0	2.2	3.4	55	6.3	3.3	92.8	86.0
" K7-649	87.5	14.7	0.7	4.1	0.3	3.1	1.5	1.8	3.8	55	7.0	4.0	94.0	86.0
" Ky 57-235	92.3	19.7	0.4	8.6		3.9	1.4	2.3	3.9	60	6.0	2.7	94.1	67.0
" Mo 2RF	98.6	17.8		7.7	0.3	3.7	1.3	1.8	2.8	57	7.0	2.3	95.5	79.5
" Mo 2RH	90.6	18.2	1.2	8.5		3.7	1.5	2.0	3.8	57	6.7	3.4	96.3	72.5
" Mo 2X4	92.8	15.6	1.0	4.8	0.3	3.6	2.0	1.5	3.2	58	8.7	2.8	97.3	78.0
" Mo 11903W	89.2	18.6		7.4	0.1	3.5	1.2	1.8	2.9	60	7.0	3.4	96.6	74.0
" OK 1031	94.7	15.8		6.1		3.2	1.9	2.1	2.6	58	6.7	2.6	97.5	77.0
" OK 1032	105.4	19.5		6.2	0.1	4.1	1.3	1.9	2.3	60	6.7	2.4	95.5	80.0
" OK 1033	104.9	19.3	1.0	8.6	0.2	3.8	1.2	1.4	2.7	60	6.7	3.0	97.8	85.5
Average	93.6	17.1	0.5	7.7	0.3	3.6	1.5	1.8	3.2	58.2	6.8	2.9	95.2	76.7

1/ Wickliffe, Kentucky; Owensboro, Kentucky; Lexington, Kentucky; Sikeston, Missouri; St Marys, Kansas; Manhattan, Kansas; Stillwater, Oklahoma and Paradise, Oklahoma.
2/ Kentucky, Missouri and Kansas
3/ Kentucky
4/ Kansas and Oklahoma
5/ Ames, Iowa
6/ Kentucky and Oklahoma
7/ Oklahoma

No hybrid was considered for AES designations.

It was MOVED BY F. A. Loeffel that the report be accepted.

Seconded and passed.

REPORT OF THE SUB-COMMITTEE ON THE 700-800 MATURITY SERIES

The 800 maturity double crosses were grown in Illinois, Iowa, Indiana, Kansas, Kentucky, Missouri, Nebraska, Ohio, Oklahoma and Virginia in 1959. The summarized data are presented in table 5.

Hybrids nominated for testing in 1960 are as follows:

Hybrid	Pedigree
Ia. 5018	(WF9 x B7)(B14 x CI.31A)
Ia. 5116	(WF9 x B14)(Oh41 x B45)
Ia. 5118	(WF9 x Hy)(B14 x CI.31A)
Ia. 5120	(WF9 x 38-11)(B14 x B45)
K4099	(WF9 x Hy)(B38 x K758)
Ky205W	(Ky211 x 33-16)(Ky 209 x H21)
Ind. 9608	(WF9 x C103)(H55 x Oh43E)
Ind. 9622	(H55 x B14)(C103 x Oh43E)
Ill.3183	(WF9 x R154)(R105 x R153)
Ill. 3343	(H49 x H55)(R71 x R74)
Ill.3347	(H49 x H55)(R74 x R101)
Ill.3357	(H49 x H51)(R74 x R101)
Mo.1005	(WF9 x B14)(Mo.4529 x Mo.5)
Mo.1023	(WF9 x B41)(Mo.5 x C103)
Ill. 3042	(WF9 x B14)(B40 x Oh45)
U.S. 13	(WF9 x 38-11)(Hy x L317)
AES 809	(WF9 x P8)(Oh43 x C103)
AES 810	(WF9 x H50)(Oh45 x Oh7B)
U.S.523W	(K55 x K64)(Ky27 x Ky49)

Table 5. Summary of performance of uniform 800 maturity series double crosses, 1959.

Pedigree	Acre Yield in Bu.	Moist. %	Lodging % Root	Lodging % Stalk	Corn Borer Rating (1-9)	Smut %	Dropped Ears %	Ear ht. Grade	H. maydis Rating	H. turcicum Rating	Stewart's Disease Rating
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Il1.3229 (WF9 x 38-11)(R109B x H60)	83	18	1	5	6.7	30	5	3.2	2.5	1.8	2.8
3357 (Hl49 x H51)(R7l4 x R101)	90	19	l4	7	6.7	8	1	3.3	2.l4	2.5	3.0
3358 (Hl49 x H51)(R7l4 x R109B)	83	20	8	5	5.0	13	l4	3.0	2.2	1.3	2.5
3363 (WF9 x R109B)(C103 x Bl4)	79	18	0	3	7.3	35	3	3.3	1.9	2.8	3.5
3049 (WF9 x Hy2)(R71 x R109B)	82	18	2	10	6.0	12	2	3.2	2.l4	2.7	3.5
Ia.5018 (WF9 x B7)(Bl4 x C.I.31A)	86	20	6	6	5.7	21	1	3.2	3.1	2.2	l4.0
5040 (WF9 x Hy)(Bl4 x Bl48)	84	18	3	9	7.3	19	l4	3.l4	3.2	2.l4	3.8
5115 (WF9 x Bl4)(Bl45 x C.I.31A)	86	18	2	9	7.0	11	0	3.l4	2.7	2.9	l4.0
5122 (WF9 x 38-11)(Bl4 x B38)	80	18	0	9	8.0	l47	5	3.6	l4.0	2.6	3.8
U.S.13 (WF9 x 38-11)(Hy x L317)	83	19	1	20	6.3	27	3	l4.0	3.1	2.3	3.5
AES809 (WF9 x P8)(Oh43 x C103)	89	20	1	9	7.0	3l4	2	3.3	2.1	2.l4	2.8
810 (WF9 x H50)(Oh45 x Oh7B)	90	19	5	6	7.0	27	0	3.3	2.9	2.l4	3.5
U.S.523W(K55 x K64)(Ky27 x Ky49)	84	22	21	11	8.3	23	3	3.9	2.2	2.5	3.3
Mean	85	19	l4	8	6.8	2l4	3	3.l4	2.7	2.l4	3.l4
Two-year performance (1958-1959)											
Il1.3049	92	18	1	8	5.7	8	3	3.2	2.l4	2.5	
Ia.5115	93	18	1	7	6.5	6	1	3.5	2.6	2.5	
U.S.13	91	19	1	20	6.7	1l4	3	3.8	2.5	2.l4	
AES809	98	20	1	8	6.l4	19	1	3.2	1.7	1.7	
AES810	98	19	3	7	6.2	17	0	3.l4	2.6	2.2	

1959 test locations:

(1) Illinois, Iowa, Indiana, Kansas, Kentucky, Missouri, Nebraska, Ohio, Oklahoma, Virginia
(2) Illinois, Iowa, Indiana, Kansas, Kentucky, Missouri, Nebraska, Ohio, Virginia
(3) Iowa, Kansas
(l4) Iowa, Kansas, Kentucky, Nebraska, Ohio, Virginia
(5) Iowa
(6) Illinois
(7) Iowa, Nebraska, Kansas
(8) Iowa, Kansas, Missouri
(9), (10), & (11) Kentucky

The 800 maturity series three-way crosses, involving WF9 x Hy and Bl4 x CI.31A as testers, were grown in Illinois, Iowa, Indiana, Kansas, Kentucky, Missouri, Nebraska, Ohio, Oklahoma and Virginia in 1959. The summarized data are presented in table 6.

Table 6. Summary of performance of uniform 800 maturity series, three-way crosses, 1959.

Pedigree	Acre Yield in Bushels	Moisture Percent	Lodging Root	Lodging Stalk	Smut Grade	Smut Percent	Dropped Ears Percent	Ear ht. Inches	Corn Borer Rating (1-9)	H. turcicum rating	H. maydis rating	Stewart's Disease rating
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
B51												
(WF9 x Hy) x ~~Ia.57:1313~~	89	18	2	7	0.7	4	9	41	5.0	2.4	3.0	4.0
x Ia.57:1357	91	21	2	9	0.0	0	6	37	4.0	2.4	3.5	3.0
x K807	82	18	0	9	1.3	2	4	35	4.0	2.4	2.9	4.3
x K808	90	19	8	18	2.0	2	9	40	4.3	3.0	1.9	3.3
x Mo.61004	90	22	5	12	2.0	3	0	39	3.3	3.3	3.7	3.3
x Mo.61018	85	22	2	9	1.0	3	3	35	4.0	2.6	3.3	4.0
x Mo.4582	103	19	1	9	1.3	2	3	43	5.0	2.0	3.1	3.5
x M74A	85	19	1	11	2.7	6	5	35	4.7	2.3	2.2	2.3
x M76	86	18	0	23	2.7	15	22	42	5.3	2.7	3.2	3.0
x M78	75	18	4	23	1.3	8	4	32	7.0	2.2	2.9	3.5
x R84	85	17	7	26	1.0	5	5	41	6.0	2.5	3.6	3.5
x R196	75	18	4	12	1.3	2	2	39	6.0	2.3	3.3	3.3
x I317	92	19	8	34	0.3	5	10	44	5.3	1.7	2.7	2.8
x 38-11	93	18	1	23	2.0	19	10	44	5.3	2.6	2.8	3.3
x H51	99	16	3	19	2.3	5	6	39	5.0	1.7	2.8	2.8
x C.I.38B	91	18	2	13	2.3	7	5	41	5.0	1.9	2.4	2.8
Mean	88	19	3	16	1.5	6	6	39	5.0	2.4	3.0	3.3
B14 x C.I.31A	92	20	0	3	1.0	3	0	40	5.7	2.8	1.9	4.5
(B14 x C.I.31A) x Ia.57:1313	93	19	0	7	1.0	0	3	42	5.0	2.2	3.3	4.0
x Ia.57:1357	90	22	0	8	0.3	2	1	37	4.3	2.6	2.6	3.3
x K807	92	18	1	5	1.3	2	1	41	4.7	2.2	2.6	4.0
x K808	91	20	12	13	2.7	9	1	41	4.0	2.8	2.4	3.3
x Mo.61004	86	22	0	8	2.0	1	0	39	6.0	2.2	2.8	3.8
x Mo.61 018	90	23	3	7	0.0	0	1	37	3.7	2.5	2.8	4.3
x Mo.4582	99	19	1	11	0.7	0	2	42	3.7	2.3	2.9	2.8
x M74A	87	20	4	5	1.7	4	1	40	3.0	2.3	1.7	3.3
x M76	92	19	1	18	1.7	6	2	45	5.0	2.6	2.7	3.3
x M78	86	20	8	14	1.3	2	1	35	5.3	2.5	2.3	3.3
x R84	92	17	3	17	1.7	6	2	42	5.3	2.7	3.7	3.8
x R196	95	18	2	8	0.7	0	2	43	5.7	2.5	3.0	3.8
x I317	90	20	8	22	0.3	3	3	45	5.3	2.6	3.8	3.5
x 38-11	91	18	1	14	2.7	6	2	43	4.7	1.9	2.7	4.8
x H51	93	19	0	14	1.3	2	3	37	6.0	1.8	2.4	3.0
x H52	93	19	1	9	1.3	4	6	49	6.0	2.6	2.4	3.3
x C.I.38B	93	19	1	12	0.7	3	2	42	4.7	2.4	2.5	3.5
x WF9	92	17	1	7	0.7	8	4	38	5.0	2.7	3.3	4.0
x M49	95	20	0	6	1.3	1	1	41	4.7	2.4	2.7	3.3
x C.I.29A	97	18	7	10	1.3	3	3	43	4.7	2.2	2.7	2.8
x Hy	93	19	1	13	0.3	1	1	43	5.0	2.7	3.2	4.3
x H55	98	19	2	8	0.7	4	1	45	4.7	1.9	2.7	2.8
x H56	93	21	1	10	0.7	0	0	45	6.0	2.5	2.6	3.3
x C.I.42	95	21	0	13	1.3	5	2	43	5.3	1.9	1.9	2.5
x B41	88	20	3	6	0.3	2	1	41	6.7	2.4	3.1	4.0
x Mo.61259	94	19	0	8	0.7	2	2	41	5.3	2.2	3.3	3.5
x Mo.53683	94	18	0	9	0.7	3	2	39	6.7	2.2	3.6	3.0
x Mo.9170	96	19	4	3	0.7	2	1	40	6.3	2.7	2.8	4.3
x Mo.9120	91	18	0	6	1.7	1	2	36	4.7	2.7	2.9	3.5
Mean	92	19	2	10	1.1	3	2	41	5.1	2.4	2.8	3.6

Table 6. (cont'd.)

(1) Illinois, Iowa, Indiana, Kansas, Kentucky, Missouri, Nebraska, Ohio, Oklahoma, Virginia
(2) Illinois, Iowa, Indiana, Kansas, Kentucky, Missouri, Nebraska, Ohio, Virginia
(3) Iowa, Indiana, Kansas
(4) Iowa, Indiana, Kansas, Kentucky, Missouri, Ohio, Virginia
(5) Indiana
(6) Illinois
(7) Illinois, Kansas
(8) Illinois, Indiana, Kentucky, Ohio, Virginia
(9) Iowa
(10) Kentucky
(11) Kentucky
(12) Kentucky

Seed available for testing in 1960 is as follows:

Line	Source	WF9 x Hy	B14 x CI.31A
R178		X	X
R194		X	X
R201	(R76 x B2)(1A)	X	X
R202	(R77 x N6)(3)	X	X
R203	(C103 x CI.540)(1)	X	X
Oh45B	[Oh45 x (M14 x 187-2)] x Oh45	X	X
Oh45C	[Oh45 x (M14 x 187-2)] x Oh45	X	X
Ia.58:1323	Corn Borer Syn. #1	X	X
Ia.58:1341	(M14 x A206) x Oh4C	X	X
K7-47	(38-11 x K10) x 38-11	X	X
K7-50	(K64 x 38-11) x K64	X	X
K6-3	CI.61 x K148	X	X
Mo.61078	Mo22 x B14 /2	X	--
Va.11b	M14 x C103	X	X
Va. 15a	H. O. outcross	X	X
Va. 20	Oh43 x Oh40B	X	X
Va. 9-701	C103 x T8 (2)	X	X
N221-2	Y63	X	X
N4402-2	Texas Yellow Dent	X	X
N2155-1-1	Nebr. Syn. A	X	X
N2179-3-2	" "	X	X
N2276-10-2	" "	X	X
N2288-7-1	" "	X	X
WF9	" "	-	X
38-11		X	X
Hy		-	X
L317		X	X
Tester		X	X

The following lines have been submitted for use in producing three-way crosses for testing in 1961:

Line	Source
Ia.59:1521	Stiff Stalk Syn.(H.D.2187)
Ia.59:1639	41:2504B x B14 /3
Ia.59:1988	B18 x A73
Va. 14a	K201 x C103 /2
H 74	[(WF9 x K148)(CI.15 x K175)](x) WF9
H 75	[(C103 x Tr)(CI.23 x NC34)](x) C103

Line	Source
R71	Corn Borer Syn. #2
R151	Corn Borer Syn. #2
R154	Corn Borer Syn. #2
H60	(Mo.21A x CI.14)(Oh28 x Ill.90)
Mo.11662	(L304A x B1)
Mo.line	(B41 x Mo.11)

No hybrid was recommended for AES designation.

R. W. Jugenheimer
J. H. Lonnquist
L. H. Penny, Chairman

It was MOVED by L. H. Penny that the report be accepted.

Seconded and passed.

The 700 maturity double crosses were grown in Illinois, Iowa, Indiana, Kansas, Nebraska, Ohio and Virginia in 1959. The summarized data are presented in table 7.

Table 7. Summary of performance of uniform 700 maturity series double crosses, 1959.

Pedigree	Acre Yield in Bushels	Moisture Percent	Lodging Percent : Root	: Stalk	Corn Borer Rating (1-9)	Aphids Percent	Dropped Ears Percent	Ear ht. Grade	Smut Percent
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Ill.3315A	92	21	57	18	5.7	0	2	3.3	2
3345	97	23	81	27	4.0	3	2	3.5	2
3347	103	22	54	16	5.3	3	1	3.5	2
3348	98	23	54	16	3.7	1	2	3.3	1
1921	98	22	68	22	6.7	8	8	3.5	3
Ia. 4989	95	20	69	12	8.3	7	0	3.4	3
4991	95	21	29	7	7.0	6	1	3.2	4
4962	92	20	82	17	6.7	10	1	3.1	4
4297	83	20	90	24	8.0	15	2	3.0	8
AES 703	94	21	22	12	6.7	13	1	3.2	3
704	96	20	83	11	7.7	3	1	3.2	2
705	96	20	13	15	6.7	6	2	3.0	3
U.S.13	99	22	--	--	5.7	--	7	4.0	-
Mean	95	21					2	3.3	3
			Two year performance (1958-1959)						
Ill.1921	106	20	35	14	6.0	--	5	3.4	2
Ia. 4989	102	19	35	8	7.2	--	0	3.3	2
Ia. 4991	102	19	15	5	6.4	--	1	3.2	2
Ia. 4297	94	18	46	16	7.7	--	2	3.1	6
AES 703	105	19	11	7	6.7	--	2	3.3	2
AES 704	104	19	42	6	7.4	--	1	3.1	3
AES 705	106	19	7	10	5.7	--	2	3.1	3

Table 7, (cont'd.)

1959 test locations:

(1) and (2) Illinois, Iowa, Indiana, Kansas, Nebraska, Ohio, Virginia

(3) Ohio

(4) Iowa, Kansas, Ohio

(5) Iowa

(6) Ohio

(7) Illinois, Kansas, Nebraska

(8) Iowa, Kansas

(9) Illinois, Ohio

Hybrid	Pedigree
Ill.3315A	(WF9 x Hy2)(R109B x B14)
Ill.3345	(R71 x R109B)(H49 x H55)
Ill.3347	(R74 x R101)(H49 x H55)
Ill.3348	(R74 x R109B)(H49 x H55)
Ill.1921	(WF9 x 38-11)(R71 x R105)
Ia.4989	(WF9 x B14)(B37 x B42)
Ia.4991	(WF9 x B14)(Oh43 x B42)
Ia.4962	(WF9 x M14)(B37 x B42)
Ia.4297	(WF9 x I205)(M14 x 187-2)
AES703	(WF9 x Oh43)(B14 x B38)
AES704	(WF9 x Oh43)(B14 x B37)
AES705	(WF9 x B14)(C103 x Oh43)
U.S.13	(WF9 x 38-11)(Hy x L317)

Hybrid nominated for testing in 1960 are as follows:

Hybrid	Pedigree
Ia.5092	(WF9 x M14)(B14 x B46)
Ia.5093	(WF9 x M14)(B37 x B46)
Ia.5095	(WF9 x Oh43)(B14 x B46)
Ind. 9602	(WF9 x H55)(B14 x Oh43)
Ill. 3022	(WF9 x B14)(N22A x Oh43)
Ill. 3152 (Ia.4953)	(WF9 x M14)(B14 x Oh43)
Ill. 3182A	(WF9 x R104)(R151 x R154)
Ill. 3315A	(WF9 x Hy2)(R109B x B14)
Ia. 4297	(WF9 x I205)(M14 x 187-2)
AES 703	(WF9 x Oh43)(B14 x B38)
AES 704	(WF9 x Oh43)(B14 x B37)
U.S. 13	(WF9 x 38-11)(Hy x L317)

The 700 maturity series three-way crosses, involving WF9 x B14 and B37 x Oh43 as testers, were grown in Illinois, Iowa, Indiana, Nebraska, Ohio and Virginia in 1959. The summarized data are presented in table 8.

Table 8. Summary of performance of uniform 700 maturity series three-way crosses, 1959.

Pedigree	Acre Yield in Bushels	Moisture Percent	Lodging Percent: Root	Stalk	Corn Borer Rating (1-9)	Aphids Percent	Ear ht. Inches	Smut Percent	Smut Grade
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
WF9 x Bl4	98	20	--	0	.	--	38	1	1.3
(WF9 x Bl4) x Ia57:1302	100	20	17	20	4.0	0	38	1	0.7
x Ia57:1766	95	24	68	3	6.3	4	38	8	2.7
x R104	95	20	18	15	6.0	0	33	2	0.7
x R135	95	22	57	18	7.7	17	36	8	2.3
x R138	108	22	60	12	7.0	1	39	3	2.3
x R195	95	18	47	14	7.0	4	36	4	2.0
x H62	107	26	43	17	5.0	0	34	0	1.3
x Oh26F	90	18	50	6	7.3	11	33	2	1.7
B37 x Oh43	106	23	3	1	---	10	33	4	1.3
(B37 x Oh43) x Ia57:1302	114	21	21	18	3.7	0	37	3	1.3
x R104	99	21	4	7	6.0	0	33	2	0.7
x R135	105	22	57	14	7.0	18	38	8	2.7
x R138	118	22	67	12	4.7	7	39	3	2.0
x R195	101	21	58	10	6.0	0	36	5	1.7
x H62	103	24	35	13	5.0	0	33	1	1.7
x Oh26F	98	19	50	5	8.0	8	32	2	1.0

(1) & (2) Illinois, Iowa, Indiana, Nebraska, Ohio, Virginia
(3) Ohio
(4) Iowa, Ohio, Indiana, Virginia
(5) Iowa
(6) Ohio
(7) Illinois, Indiana, Virginia
(8) Illinois, Ohio
(9) Indiana

Seed available for testing in 1960 is as follows:

Line	Source	WF9 x B14	B37 x Oh43
R108		X	X
R175		X	X
R192		X	X
R200		X	X
Oh45C	[Oh45 x (M14 x 187-2)] x Oh45	X	-
Ia.58:1323	Corn Borer Syn. #1	X	X
Ia.58:1321	Oh45 x W92	X	-
H64	Syn. A	X	X
H66	Syn. B	X	X
H72	NC34 x WF9 1/2	X	X
N82076	N6/H.G.	X	-
N211	Y41	X	-
Tester		X	X
Oh45B	[Oh45 x (M14 x 187-2)] x Oh45	X	-
Va. 25	Oh43 x W24	X	-
Va. 26b	Oh43 x K155	X	-
Va. 9-525	Oh43 x C103	X	-
Va. 9-538	Oh43 x M14	X	-

The following lines have been submitted for use in producing three-way crosses for testing in 1961:

Line	Source
Ia.59:1545	Stiff Stalk Syn. (H.D.2479)
Ia.59:1620	N32 x B14 1/2
Pa. 881P	K155 x A321
Pa.887P	[(Oh04 x NC34) x A71] x Hy
Va. 11a	M14 x C103
Va. 9520	Oh43 x C103
Va. 9347	Oh43 x M14
R151	Corn Borer Syn. #2 (Snelling)
R154	Corn Borer Syn. #2 (Snelling)
R181	Corn Borer Syn. #2 (Snelling)

REPORT OF THE SUB-COMMITTEE ON THE 400, 500 and 600 MATURITY SERIES

Double cross trials involving the uniform 500 and 600 maturity series double crosses were grown at South Dakota, Illinois, Iowa, Ohio, Nebraska, Michigan and Minnesota. The data are recorded in table 9. No hybrids had been tested for a 2-year period and therefore none was eligible for consideration for an AES designation.

Table 9. Summary of performance of uniform 500 and 600 maturity series double crosses, 1959.

Hybrid	S.D.	Grain Yield: Ill.	Iowa	Ohio	Neb.	Mich.	Minn.	Av. yield	H_2O	Lodging	Stand	D. Ears	Ear ht.	Plant ht.	Silk
		Bushels per acre							%[1]	2)	3)	4)	5)	6)	7)
AES 510	71	104	111	101	115	99	- *	100.1*	21.3*	25*	94	4.7*	42*	- *	72
AES 514	75	106	109	108	96	98	108	99.9	22.5	10	95	.05	45	102	71
AES 601	81	103	94	92	106	104	- *	96.7*	23.1*	17*	94	.8*	40*	- *	73
AES 610	68	107	101	104	98	92	- *	94.9*	21.7*	17*	95	1.3*	40*	- *	71
Ill.1960	73	114	112	101	100	96	104	99.9	23.2	14	97	.0	42	103	72
Ill.1969A	75	112	92	111	105	107	108	101.5	26.4	11	96	1.1	46	110	73
Ill.3009	73	109	108	102	107	104	108	101.6	23.8	24	97	1.2	47	109	74
Ill.3265	71	113	102	121	106	102	110	103.5	28.2	14	98	1.3	42	110	74
Ill.3266	78	122	102	117	105	99	108	104.3	26.8	11	96	2.3	41	111	73
Ill.3302	76	121	119	116	104	105	108	106.9	24.1	16	99	.8	45	112	73
Ia.4967	75	125	106	104	111	100	110	104.4	25.3	16	99	2.6	48	111	76
Ia.5052	72	109	100	99	93	85	106	94.9	23.9	16	96	3.7	41	110	72
Ohio M15	66	98	90	87	85	81	92	85.5	22.9	40	95	1.8	44	104	72
Ohio K24	66	97	95	97	101	82	102	91.4	24.6	21	94	2.9	43	114	74

1) S. Dakota, Ill., Iowa, Ohio, Nebr., Mich. Minn.
2) Ill., Iowa, Ohio, Neb., Mich., Minn.
3) Ill., Iowa
4) Iowa, Neb., Minn., Ill.
5) Minn., Ill.
6) Minn.
7) Ohio

* Data not obtained on these hybrids at Minnesota.

Performance trials for 3-way crosses were grown at Michigan and Ohio. The data are recorded in table 10.

Table 10. Summary of performance data for the uniform 500-600 maturity series three-way crosses, 1959.

Lines Tested*	Yield			H_2O			Lodging		Silk	Smut	Aphids
	Mich.	Ohio	Av.	Mich.	Ohio	Av.	Mich.	Ohio R S	Ohio	Ohio	Ohio
Oh45B	74	128	101	21	26	23	5	68-29	72	0.0	1.3
Oh45C	71	114	93	22	26	24	5	50-19	76	0.0	5.7
H42	63	79	71	21	24	23	6	72-53	75	0.0	19.4
H46	58	80	69	20	24	22	6	69-32	76	0.0	26.4
H41	57	72	65	20	25	23	4	53-35	77	1.4	30.5
H45	68	79	74	20	23	22	3	63-19	73	2.8	29.1
W22	66	118	92	19	23	21	5	83-49	75	0.0	0.0
W182-D	59	100	80	18	20	19	5	74-39	71	4.2	0.0
W375-R5	62	80	71	20	22	21	1	40-19	70	1.4	26.4
W-202	64	89	77	20	22	21	1	6-13	70	1.4	20.8
W64A	67	69	68	20	23	22	3	78-49	72	0.0	22.2
W153R	56	81	67	19	20	19	1	31-28	66	4.2	13.9
W20R	60	89	73	20	24	22	7	65-33	73	1.4	16.7
W-22R	72	103	88	20	23	22	13	89-57	76	1.4	4.2
W32	56	78	67	20	23	22	10	53-31	72	2.8	20.8
B42	82	113	98	22	24	23	4	83-25	72	0.0	0.0
B37	60	96	78	20	23	22	4	71-22	74	1.4	18.0
B46	68	112	90	20	23	22	5	78-49	77	1.4	5.6
PA. 11	70	83	77	19	21	20	2	22-29	66	1.4	6.9
PA. B8A	62	76	69	18	19	18	2	14-22	70	4.2	5.6
PA. 23	72	114	93	20	26	23	3	50-19	70	0.0	13.9
PA. 70	62	114	88	22	25	24	2	82-40	74	1.4	5.6
PA. 32	60	89	75	19	20	19	6	35-48	69	2.1	1.6
MS130	63	95	79	19	22	21	6	78-74	71	0.0	0.0
MS129	67	106	87	21	25	23	4	39-21	73	0.0	0.0
MS68	52	85	69	19	24	22	3	57-19	67	11.1	5.6
R61	69	107	88	21	26	24	7	85-38	77	0.0	6.9
R168	68	87	78	19	22	21	1	15-24	71	6.9	18.0
R181	76	111	94	19	22	21	4	53-49	72	2.8	8.3

*TESTER (Oh51A x Oh26D) (Oh26A x Oh26F)

Double crosses nominated for the 400-500-600 uniform tests for 1960 were as follows:

Line	Pedigree
Iowa 5052	(WF9 x M14)(Oh51A x W182D)
" 5063	(WF9 x M14)(B14 x A257)
" 5129	(WF9 x M14)(B9A x W182D)
Ill. 3302A-1	(W64A x M14)(R172 x B14)
" 1952	(W64A x A545)(M14 x B14)
" 3301	(M14 x Oh43)(R168 x B14)
" 6201	(WF9 x B14)(R53 x Oh07)
Mich.57-36	(MS57 x MS100)(B14 x MS80)
" 56-115	(Oh43 x MS111)(MS143 x MS113)
" 59-462	(WF9 x M14)(R168 x MS109)
" 59-487	(WF9 x Oh51A)(R168 x MS109)
" 59-515	(W32 x W64A)(Iowa 24 x MS109)

Single cross seed available for 1960 tests. Diallel series involving the following lines.

Inbred	Origin	Inbred	Origin
WF9	Reid Yellow Dent	MS116	Duncan o.p.variety
W64A	WF9 x Krug	MS128	Oh10M15
M14	BR10 x R8	MS129	Hy2 x MS113
Oh43	W8 x Oh40B	A427	CC x A405
R158	[HP x Hy2(F)]	A570	Minn. C.B. Syn.#2
R181		A622	(A298 x Amargo 41:2504B) A298

Three-way seed of the uniform 500-600 maturity series available for testing in 1960.

Inbred	Origin
Oh45B	[Oh45 x (M14 x CI.187-2)] x Oh45
Oh43C	
H71	
Pert. LP-8	Indiana
R54	[A x (4211 x 2204)] x A41-2126-1
R158	[HP x Hy2 (F) Y]
R193	[(B2 x Oh51A)(2)]
R198	[N6 x Oh45(4)]

Inbred	Origin
Va.8-346	Lancaster S6
Va.8-351	" S6
Va.8-357	" S6
Mich. 59-1	MS24A x 38-11
" 59-2	WF9 x Oh40B
" 59-3	Fordon o.p. variety
" 59-4	(W23 x Oh51A)

Testers

T1	WF9 x M14
T2	Oh43 x W64A
T3	WF9 x Oh43
T4	W64A x W22
T5	M14 x W64A

Inbreds nominated for diallel series to be made in 1960 for 1961 tests:

Inbred	Origin
Ia.51-1588	(W24 x B2)-2-1-2-1-1
B50	[(M14 x A206)Oh4c]-26-5-2-2-1
Oh33	A322 x B2
Oh57	W24 x B2
R181	Corn Borer Syn. #2 323(2)
Mich. 60-1	Iowa Stiff Stalk Synthetic
" 60-2	(187-2 x MS1)
" 60-3	(L317 x 38-11) MS1334
" 60-4	(Jellicorse x M14) MS1341
" 60-5	(38-11 x Hy) MS211
H73	Oh51A Recovery

Submitted by N. P. Neal
E. E. Rossman
L. F. Bauman, Chairman

It was MOVED BY L. F. Bauman that the report be accepted.

Seconded and passed.

REPORT OF THE SUB-COMMITTEE ON THE 100, 200 and 300 MATURITY SERIES

No uniform tests of 100 maturity material was grown in 1959. Uniform test of 200 and 300 maturity double crosses were grown in North Dakota, Wisconsin, Michigan, Ontario and South Dakota. The data obtained are recorded in tables 11, 12 and 13. No requests were made for AES designations.

E. H. Rinke
A. M. Strommen
Wm. Wiidakas, Chairman

It was MOVED by Wm. Wiidakas that the committee report be accepted.

Seconded and passed.

Table 11. Records for yield and moisture percentage for the uniform 200 and 300 maturity series double crosses, 1959.

Hybrid No.	Yield bu./A. by states N.D.	Wis.	Mich.	Ont.	S.D.	% of ND502	Moisture % in ears N.D.	Wis.	Mich.	Ont.	S.D.	% of ND502
AES 202	60.5	81.5	46.	68.8	32.8	86.4	19.3	40.6	24.	25.1	26.0	87.8
M. Exp. 156	62.2	68.6	66.	66.1	30.4	87.5	22.1	41.9	23.	24.0	26.1	89.2
M. Exp. 157	68.0	74.8	58.	65.9	31.8	89.1	21.3	40.3	25.	28.0	26.5	91.8
AES 204	57.7	63.5	51.	63.3	22.9	77.1	21.1	38.3	24.	28.1	27.7	90.6
W273	61.3	92.9	51.	-	28.7	92.9	21.6	41.6	23.	-	27.2	93.6
W1684	58.3	84.4	49.	-	27.6	87.1	23.3	43.0	25.	-	29.2	99.4
ND307	66.1	72.6	49.	65.8	31.6	85.1	23.2	38.3	24.	28.2	26.1	91.0
ND502	70.0	89.0	61.	83.4	31.7	100.0	24.6	40.8	26.	32.5	29.8	100.0
ND Exp. 3-30	63.7	95.3	54.	67.5	32.5	93.4	28.7	45.6	28.	35.2	33.4	111.2
ND Exp. 159	65.0	102.9	50.	74.0	25.1	94.6	25.3	43.9	28.	33.4	38.7	110.1

Table 12. Summary of performance of the uniform 200 and 300 maturity series double crosses, 1959.

Pedigree	Hybrid No.	Acre Yield Bu. 1/	Moisture % ears 1/	Days to silk 2/	Lodging Root % 3/	Lodging Stalk % 3/	Shelling % 4/	Height inches Plts. 5/	Height inches Ears 5/
CMD5xW59M:W509xMS1334	AES 202	57.9	27.0	60	6.0	2.0	80.2	87	28
B8xND203:A498xMS1334	M.Exp. 156	58.7	27.4	61	12.0	2.0	80.7	87	29
A498xA90:ND203xMS1334	M.Exp. 157	59.7	28.2	60	10.0	3.5	78.8	86	29
W33xA509:A508xND203	AES 204	51.7	27.8	60	9.0	3.5	79.7	84a	28
W59MxW117:W1.82B	W273	62.2a	28.7a	61	3.5	3.0	83.0a	87a	29
W491xW525:W375AxW182B	W1684	58.4a	30.5a	62	8.5	2.0	83.0a	88a	30
ND230xND203:A90xMS1334	ND307	57.0	28.0	60	15.0	3.0	78.5	85	29
A498xMS1334:A508xA509	ND502	67.0	30.7	61	8.5	2.5	80.3	88	28
W79AxCM145:MS1334	ND Exp. 3-30	62.6	34.2	61	9.0	5.5	80.9	90	32
B8xND203:Q155xQ153	ND Exp. 159	63.4	33.9	62	14.0	4.5	82.0	93	33

1/ Five state average yield and moisture: N.Dak., Wis., Mich., Ont., S.Dak.
2/ Days from emergence to mid-silk: N.Dak.
3/ Lodging, root and stalk average: N.Dak., Mich.
4/ Shelling average: N.Dak., Wis., Ont.
5/ Plant height: N.Dak., Ont. Ear height: N.Dak.
a/ Adjusted average, less Ontario.

Table 13. Summary of performance of the uniform 200 and 300 maturity series double crosses for 1958 and 1959.

Hybrid No.	Yield bu./A. by states N.D.	Wis.	Mich.	Ont.	S.D.	Av.	Moist. % Av.	Lodging % 6/ Root	Lodging % 6/ Stalk
AES 202	59.9	81.5	51.5	77.2	36.4	61.3	29.8	4.0	6.7
AES 204	58.3	72.6	53.5	68.7	29.4	56.5	29.6	5.8	6.1
W273	57.0	84.7	56.5	71.3a	28.4	59.6	32.1	2.3	3.5
ND 307	64.2	76.3	52.0	72.1	32.4	59.6	30.1	8.2	9.1

6/ Average two years: N.Dak. and Mich.
a/ Adjusted average.

Resistance to Leaf Feeding by the European Corn Borer

Since several states in the North Central Region do not have the necessary facilities to obtain corn borer leaf feeding information, it was considered desirable that this information should be obtained and made available for lines that have been released in the past ten years or expected to be released in the near future. All states were invited to send approximately ten lines and approximately 100 lines or strains were obtained from nine states in the North Central Region. The material was grown at Ames in the corn borer breeding nursery. The conditions were very desirable for obtaining leaf feeding information. The test consisted of three replications of each entry grown in ten plant plots. Natural infestation was supplemented by three egg masses per plant applied manually in three lots of one egg mass each two days apart.

Mr. F. F. Dicke made the ratings approximately three weeks after the artificial infestations. The ratings were made using a nine class rating scale based on both the amount of feeding and the size of the individual feeding areas. The entries rating one to three indicate "pinpoint" to "shothole" wounds and slightly elongated holes in the leaves and is regarded as an indication of resistance. Somewhat larger and more elongated feeding areas, indicating an intermediate resistance, were rated four to six. Susceptible ratings of seven to nine were assigned to plants showing a feeding pattern characterized by ragged, oblong shaped holes varying in length up to one inch or more.

The ratings presented in table 14 are the average plot ratings for the three replications. The lines 41.2504B, MS1, Oh45, Oh43, P8 x 61-67, WF9 and L317 were entered as checks. Only one line, B49, in the test was as resistant as the most resistant check, 41.2504B. However, B49 is a selection from the cross (A277 x 41.2504B). Other lines that appear to have resistance are K745, MS1334, and B46.

F. F. Dicke
A. R. Hallauer

Table 14. Summary of European Corn Borer leaf feeding ratings obtained on 101 inbred lines representing nine states in the North Central Region compared in experiment 43 and grown at Ames, Iowa, in 1959.

Inbred	Average	Inbred	Average
H49	7.3	MS211	7.3
H52	5.7	MS213	7.3
H55	4.0	MS214	4.7
H59	5.3	MS1334	3.0
H60	3.3	W117	8.3
H71	5.0	W59M	5.0
H72	7.0	Wh1A	5.3
H63A	6.3	W22R	3.7
H64	6.3	W59E	7.0
H65	4.3	W64A	8.0
Ky201	6.0	W37AR2	5.7
Ky209	6.3	W37A	7.3
Ky211	7.3	W153R	8.0
Ky56-150	7.3	W182D	4.7
Ky56-126	5.3	B14	7.7
Ky36-11	6.3	B37	6.7
Ky108	8.0	B38	6.7
Ky120	8.0	B43	6.0
Ky55-562	9.0	B45	5.7
N6	7.0	B46	3.0
N6D	7.7	B47	4.3
N15	6.0	B48	7.0
N24	5.3	B49	2.0
N16	3.3	A417	5.3
N25	5.7	A498	5.0
82076 (N6/HG)	6.7	A509	6.0
211 (Yh1)	7.3	W33	8.3
221-2 (Y63)	8.7	CMD5	5.3
4402-2	5.7	A427	7.0
H10	7.3	A556	8.7
K166	8.3	A297	8.3
K201R	7.3	A251	6.0
K711	4.7	A239	7.0
K712	5.3	A401	3.3
K735	5.7	A295	5.3
K745	3.0	Mo9689	4.7
K766	8.7	Mo0225	5.3
K5470	5.3	Mo9275AW	4.0
K5516	5.7	Mo1602-1	7.7
K5668	5.0	Mo72075W	7.7
MS4	5.7	Mo91A5W	7.3
MS106	7.7	Mo2R.F.	4.7
MS107	5.7	Mo01932	4.7
MS109	3.7	Mo61156	4.7
MS111	6.0	A1.250AB	2.0
MS114	7.3	MS1	3.7
MS116	4.7	Oh45	3.7
MS128	5.7	Oh43	3.7
MS129	4.0	P8 x 61-67	3.7
MS208	3.3	L317	4.0
		WF9	7.7

It was MOVED by W. A. Russell and seconded by M. S. Zuber that: Starting in 1961 all double crosses nominated for the first year of regional testing must contain at least one unreleased line.

Motion passed.

It was MOVED by J. H. Lonnquist that the Secretary be instructed to express the appreciation of the group to the Illini Center for the privilege of using their facilities for the meeting. The motion was seconded by E. R. Leng and passed.

It was MOVED by N. P. Neal that the North Central Corn Breeding Research Committee express its appreciation to the Chairman and the several committees for the fine way in which the affairs of the committee were handled during the past year. Seconded by J. H. Lonnquist and passed.

Meeting adjourned.

The Executive Committee appointed Wm. R. Findley, Jr., to serve as Chairman for 1960-61. The following committees were appointed.

Committees for 1960-61

Preservation of Germ Plasm.
J. H. Lonnquist, E. J. Dollinger and D. B. Shank (Chairman)

Grouping of Lines for Breeding Purposes.
N. P. Neal, L. F. Bauman, W. A. Russell (Chairman)

Cytoplasmic Male Sterility and Restorers.
J. H. Lonnquist, W. A. Russell and J. B. Beckett (Chairman)

Cooperative Winter Nurseries.
L. F. Bauman, E. J. Dollinger, M. S. Zuber, E. C. Rossman(Chairman)

Meeting Place.
D. B. Shank, M. S. Zuber, P. Crane (Chairman)

Certification Programs.
N. P. Neal, L. F. Bauman, W. A. Russell (Chairman)

Stalk Rot.
Paul Hoppe, M. S. Zuber, A. L. Hooker (Chairman)

Uniform Tests in the 900 Maturity Series.
W. R. Findley, Jr., P. J. Loesch and F. A. Loeffel (Chairman).

Uniform Tests in the 700-800 Maturity Series.
E. R. Leng, J. H. Lonnquist and L. H. Penny (Chairman).

Uniform Tests in the 400-500-600 Maturity Series.
N. P. Neal, E. C. Rossman and L. F. Bauman (Chairman).

Uniform Tests in the 100-200-300 Maturity Series.
E. H. Rinke, A. M. Strommen and Wm. Wiidakas (Chairman).

ROSTER OF ATTENDANCE

Canada

Giesbrecht, John
Helgason, S. B.

Illinois

Beckett, J. B. (USDA)
Hageman, R. H.
Hooker, A. L.
Leng, Earl R.

Indiana

Bauman, L. F.
Crane, Paul
Shay, J. R.
Ullstrup, A.J. (USDA)
Volk, N. J.

Iowa

Dicke, F.F. (USDA)
Hallauer, A.R. (USDA)
Penny, L.H. (USDA)
Russell, W. A.

Kansas

Findley, Wm. R. (USDA)
Scott, Gene E. (USDA)

Kentucky

Loeffel, F. A.

Maryland (Beltsville)

Sprague, G. F. (USDA)

Michigan

Rossman, E. C.

Minnesota

Sentz, J. C.

Missouri

Loesch, P. J. (USDA)
Zuber, M. S. (USDA)

Nebraska

Lonnquist, J. H.

Ohio

Dollinger, E. J.

North Dakota

Wiidakas, Wm.

South Dakota

Shank, Boyd

Virginia

Genter, C. F.

Wisconsin

Hoffbeck, L. J.
Hoppe, Paul E. (USDA)
Neal, N. P.
Rowe, P. R.
Strommen, A. M.

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